Notice of Written *Ex Parte*

June 21, 2016

Ms. Marlene H. Dortsch
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington,D.C. 20554

Re: In the matter of Use of Spectrum Bands Above 24 GHz for Mobile Radio Services, GN Docket No. 14-177

Dear Ms. Dortsch,

Intel submits the attached simulation study of satellite earth station interference into 5G systems in the 28 GHz band, performed by Roger LeClair of LeClair Telecommunications (please see leclairtelecom.com). The analysis used 5G system parameters based on Intel's link budget submitted into the record on 2/26/16, and using satellite system parameters obtained from FCC applications and related documentation. The simulation results show maximum separation distances under a range of operational parameters. In addition to these results, the analysis also determined power flux density (pfd) limits necessary to protect 5G systems, to be used as coordination trigger levels in conjunction with proposed coordination distances. Specifically, based on this analysis, Intel proposes a coordination trigger that, if exceeded around a given FSS site, would require the FSS operator to coordinate with the relevant terrestrial operator in order to bring its pfd level to the acceptable level.

Description of the analysis:

To begin this analysis, Intel carefully reviewed the coexistence studies submitted into the record by various parties. As we stated in our written *ex parte* dated 5/24/16, accurate coexistence results require assumptions that are representative of actual terrestrial mobile systems and envisioned usage scenarios for 5G services.

In the attached *ex parte* submission, a coexistence study based on a representative terrestrial 5G system operating at 28 GHz and 1) a GSO FSS system (ViaSat, Inc.) and 2) a NGSO FSS system (O3B) is presented. The study focuses on the protection of terrestrial 5G systems from interfering FSS earth stations. The study considered actual FSS earth stations using the data contained in FCC applications and other related documentation, rather than the generalized classes of earth stations which SIA has provided to various parties.

For the GSO case – 1) a typical CONUS earth station based in Englewood, CO, 2) an earth station located in Anchorage, AK (14.93 deg.) which has the smallest elevation angle among ViaSat stations within the United States, and 3) an earth station in Carlton, MN (33.31 deg.), which has the smallest elevation angle within CONUS. The analysis is repeated for these locations to quantify the effect of lower elevation angles on the maximum separation distance. The analysis also includes a summary table of the maximum separation distances for the aforementioned earth stations. Since the system parameters are different for each earth station, the resulting maximum separation distances span a wide range. The differences in the choice of propagation model used also results in large differences.

For the NGSO case – The O3B earth station located in Vernon, TX is considered and its variation in pointing is simulated over time. Maximum separation distance around the NGSO earth station needed to meet the 5G base station protection criterion is calculated during the satellite pass. A summary table lists the maximum separation distances needed to protect the 5G mobile and base stations.

For both GSO and NGSO cases, the analyses are repeated for a variety of I/N levels in order to represent the more typical cases of network performance degradation that could happen in real deployments.

Based on the assumptions and separation distance results noted in the attached analysis, Intel proposes pfd limits that would protect a typical base station under worst case conditions where the base stations point toward the FSS earth station. The base station pfd limit has the smallest magnitude (compared to CPE or mobile devices) and, therefore, the most stringent requirement, so the base station is used as the point of reference. Using the separation distances and pfd calculations contained in the attached analysis, Intel proposes a "coordination trigger level" of -90.3 dBm/m^2 in 1 MHz (see section 5 of the attachment), measured at 200 meters[1] from the FSS antenna at 10 meters above the ground. If this level is exceeded at the proposed distance, the FSS operator would need to coordinate its operations with the affected mobile operator in order to bring the pfd to acceptable levels, e.g. through interference mitigation techniques such as shielding. Also, even though in many cases the separation distances are less than 200 meters, the existing FSS facility and associated perimeter fencing or other natural exclusion areas may provide sufficient buffer distance to existing FSS earth stations.

Respectfully submitted,

/s/ Peter Pitsch
Reza Arefi
Dave Horne

Intel Corporation
1155 F St. NW Suite 1025
Washington, D.C. 20004

[1] We note that further analysis covering a wider range of deployment conditions might be necessary to determine a final distance value for the pfd trigger. The proposed 200 meter figure is based on the worst-case base station orientation which results in maximum interference. However, in many cases the 5G receive antenna might not be located along the worst case azimuth direction of the FSS earth station, and the 5G receive antenna might not be pointed directly at the FSS earth station. Therefore the proposed 200 meter figure represents a tradeoff between excessive restrictions on earth stations on the one hand, and undue restrictions on future 5G deployments on the other.